

## PRINTER

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

The present invention relates to a compact printer such as an electronic cash register that is employed in, for example, a POS (Point of Sale) system, and particularly to a printer having a paper near end detecting means for detecting the residual quantity of a roll paper.

#### 2. Description of the Related Art

The printer for the electronic cash register has been well known in which paper is drawn out from the roll contained in a paper holder, printed by a thermal print head on its transporting path and thereafter issued as a receipt. In the printer of this type, the roll of paper may be just thrown into the paper holder without rotatably supporting the roll core to ease the exchange of the roller. The roll of paper is reduced in diameter with consumption of paper until it finally comes to the paper exhaustion. The printer may be provided with a paper near end detecting means for detecting the amount of remaining paper immediately before paper out to warn that the exchange of the roll is needed.

The above-mentioned printer may be placed on a horizontal table, or vertically placed on the wall. The paper holder of the printer is provided with two guide portions (for horizontal

placement and vertical placement) for stably holding the roll in a predetermined accommodation position according to the installation state. In the case where the paper near end detecting means is provided, it is desirable that its detecting position can be changed in correspondence with two guide portions. Japanese Patent Unexamined Publication No. 9-295436 discloses a printer in which the paper near end detecting means is rotatably disposed with respect to those two guide portions to detect near end of paper when the detector enters a cavity portion of the roll core.

In order to change the detecting position by rotating the paper near end detecting means, a user is required to conduct operation in a limited space within the paper holder, which possibly needs a tool in some cases, resulting in troublesome and often difficult operation at the user level. The user must conduct operation every time the installation state of the printer is changed, which is also troublesome for the user. In order to solve the above problem, a dedicated machine for the horizontal placement or the vertical placement may be separately provided, but there is the drawback that the installation state cannot be changed, and the manufacturing or product management costs may increase.

#### SUMMARY OF THE INVENTION

The present invention has been made under the

above-mentioned circumstances, and therefore an object of the invention is to provide a printer that can correctly detect the residual quantity of a paper according to an installation state of the printer, which requires no operation of moving the paper near end detecting means according to the installation state, thereby lightening the burden on the user.

According to a first aspect of the present invention, there is provided a printer comprising: a paper holder provided with a plurality of guide portions for positioning a roll of paper, the plurality of guide portions being disposed with respect to a plurality of installation states of the printer, respectively; and paper near end detecting means comprising a detector disposed to be engageable with an end face of the roll of paper to detect that the amount of remaining paper is below a predetermined amount; wherein the detector is provided in the plural with respect to the plurality of guide portions, respectively; and wherein the plurality of detectors are disposed within a range that is defined by a locus of the center of the roll of paper as reduced in diameter with respect to one of the plurality of guide portions, a locus of the center of the roll of paper as reduced in diameter with respect to the other of the plurality of guide portions, and an inner surface of the paper holder between the plurality of guide portions.

With the above constitution, the printer may be installed in two ways of the horizontal placement and the vertical

20200520 0556/9001

placement, and correspondingly the paper holder has two guide portions for positioning the roll of paper in place. And the paper near end detecting means has the detectors for the two guide portions. In either installation state, the residual quantity of paper at present can be correctly detected by the detector corresponding to each of the guide portions. Accordingly, there is no need for the operation of moving the paper near end detecting means in accordance with the installation state of the printer as conventionally performed, thereby lightening the burden on the user. Also, the detectors are disposed within the range, whereby the paper near end detecting means can be made compact and simplified in the constitution.

The preferred mode of the invention will be set forth below.

First of all, the plurality of detectors are integrally connected by the connecting member. In this invention, one of the plurality of detectors is engaged with the roll of paper, but if the detectors are integrated by the connecting member to be operable as a piece, one switch may be satisfactory in response to the plurality of detectors. Thereby, the number of parts is reduced, and the constitution is simplified. This constitution can be easily achieved when the plurality of detectors are disposed within the range.

Also, the detectors are movable to change the diameter

of the roll of paper for detection. Thereby, the amount of remaining paper for triggering the warning can be changed arbitrarily. Also, even when the core diameter or the paper thickness is varied, the diameter of the roll for detection can be adjusted to be constant.

Further, according to a second aspect of the invention, there is provided a printer comprising: a paper holder provided with a guide portion for positioning a roll of paper; and paper near end detecting means comprising a detector disposed to be engageable with an end face of the roller of paper to detect that the amount of remaining paper is below a predetermined amount; wherein a gap is provided in the paper near end detecting means through which paper drawn from the roll is conveyed after the detector gets disengaged with the end face of the roll of paper.

With the above constitution, there is no interference between the paper and the detector, whereby there occurs no malfunction of detection.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a right side view of a printer, partially in cross section, according to an embodiment of the present invention;

Fig. 2 is a right side view of the printer, partially in cross section, according to the embodiment of the invention;

Fig. 3 is a left side view of the printer, partially in cross section, according to the embodiment of the invention;

Fig. 4 is an upper view of a printer main body according to the embodiment of the invention; and

Fig. 5 is a view of the printer main body taken along the arrow V-V in Fig. 4.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

An embodiment of the present invention for a small printer for electronic cash register will be described below with reference to the accompanying drawings.

Figs. 1 and 2 are right side views of a printer 1, partially in cross section, and Fig. 3 is a left side view of the printer 1, partially in cross section. The printer 1 includes a printer main body 2 having a paper holder 10 for holding a thermosensible paper S that has been rolled into a tube shape and a thermal print head 20 for printing on the paper drawn from the roll of paper S, and a cover 3 for covering an upper portion of the paper holder 10. Fig. 4 is an upper view of the printer main body 2, and Fig. 5 is a view of the printer main body 2 taken along the arrow V-V in Fig. 4.

The printer 1 allows for two installation states including a horizontal placement and a vertical placement. The printer 1 has, in its horizontal placement, a front side to the left and a rear side to the right in Figs. 1, 2 and 4, or the rear

side to the left and the front side to the right in Fig. 3. The left and right sides of the printer 1 appear in the case where the printer 1 is seen in a direction from the front to the back. The direction of front, rear, left or right in the following description is defined in the horizontal placement, unless specifically noted.

As shown in Figs. 1 to 5, the printer main body 2 has front and rear frames 4 and 5, in which the paper holder 10 is secured on the rear frame 5. The paper holder 10 has left and right side plates 11 and 12, a bottom plate 13 and a rear plate 14, and contains the roll of paper S within the paper holder 10. As shown in Figs. 1 to 3, the bottom plate 13 is curved in the shape of a recess in the front and rear directions, and a guide groove for horizontal placement (guide portion) 15A extends in the left and right directions in an almost central portion of the bottom plate 13. A guide groove for vertical placement (guide portion) 15B extends in the left and right directions in a region defined by a rear end portion of the bottom plate 13 and a lower end portion of the rear plate 14.

As shown in Figs. 1 to 3, the roll of paper S is contained within the paper holder 10 in a state where a leading end of the roll of paper S is drawn out from the lower side to the front side. The roll of paper S is reduced in diameter with its consumption, but in the case where the printer 1 is horizontally placed, the guide groove for horizontal placement

15A retains the roll of paper S as the roll of paper S is reduced in diameter. The printer 1 can be used in vertical placement with the rear plate 14 of the paper holder 10 downside. In this case, the guide groove for vertical placement 15B retains the roll of paper S, as the diameter of the roll of paper S is smaller. In any case, the roll of paper S, while being reduced in diameter, is retained at a certain accommodation position by the guide grooves 15A and 15B.

As shown in Figs. 1 to 4, the front frame 4 has the print head 20 mounted thereon. The cover 3 is hinged rotatably at its rear end portion to the rear plate 14 of the paper holder 10. A platen roller 21 is attached onto the front end portion of the cover 3, that is its rotational end portion. The platen roller 21 presses against the print head 20 when the cover 3 is closed, and rotates in a direction of conveying the paper (clockwise direction in Fig. 1) by a drive motor not shown secured to the front frame 4. The roll of paper S has a leading end drawn outside when the cover 3 is open, and pinched between the print head 20 and the platen roller 21 when the cover 3 is closed. In this state, the print head 20 makes the printing on the paper while the platen roller 21 conveys it.

The paper near end detecting means 30 is disposed on the outside of the right side plate 12 of the paper holder 10. The constitution and the mounting structure will be described below.

As shown in Fig. 5, the paper near end detecting means



30 is made up of a switch 32 having a lever 31 and two button detectors 33A and 33B that turn on or off the switch 32.

The detectors 33A and 33B are connected integrally via a substantially triangular plate (connecting member) 34 and projects from the plate 34, as shown in Figs. 2 and 5. The detectors 33A and 33B have a certain gap 34a therebetween, and are slightly offset from each other in front and rear directions, as shown in Figs. 2 and 3. In this case, a lower detector 33A is for horizontal placement, and an upper detector 33B is for vertical placement, whereby the detector for horizontal placement 33A is disposed closer to the guide groove for horizontal placement 15A and the detector for vertical placement 33B is disposed closer to the guide groove for vertical placement 15B.

The plate 34 coupling these detectors 33A and 33B has its upper end portion suspended by a bracket 35 via a pair of shafts 35b so that the plate 34 may be rotatable in right and left directions. The side plate 12 is formed with long holes 36A and 36B extending in the front and rear directions to enable the detectors 33A and 33B to project into the paper holder 10. The bracket 35 is disposed below a shelf portion 12a formed integrally at an upper end of the side plate 12, and engaged with the shelf portion 12a to be movable in the front and rear directions via a pair of engagement portions 35a provided on an upper end portion of the bracket 35.

The bracket 35 is positioned with respect to the shelf

portion 12A such that one of the engagement portions 35a is engaged at any of two front and rear positions on the shelf portion 12a. If the bracket 35 is positioned at the front side, the detector for horizontal placement 33A comes closer to the guide groove for horizontal placement 15A, while the detector for vertical placement 33B is positioned far away from the guide groove for vertical placement 15B. Thereby, the diameter of the roll of paper S detected by the detector 33A is smaller, and conversely, the diameter of the roll of paper S detected by the detector 33B is larger. Also, if the bracket 35 is positioned at the rear side, the detector for horizontal placement 33A is far away from the guide groove for horizontal placement 15A, while the detector for vertical placement 33B comes closer to the guide groove for vertical placement 15B. Thereby, the diameter of the roll of paper S detected by the detector 33A is larger, and conversely, the diameter of the roll of paper S detected by the detector 33B is smaller. In this way, the diameter of the roll of paper S to be detected, that is, the amount of the remaining paper to be detected can be adjusted by moving the detectors 33A and 33B forward or backward together with the bracket 35.

Each of the detectors 33A and 33B is disposed within a range P in the shape of a fan that is delineated by 1) a locus (indicated by the broken line A) of the center of the roll of paper S as reduced in diameter with respect to the guide groove

15A, 2) a locus (indicated by the broken line B) of the center of the roll of paper S as reduced in diameter with respect to the guide groove 15B, and 3) an inner surface of the bottom plate 13 of the paper holder 10 between the guide grooves 15A and 15B, as shown in Figs. 2 and 3. The detectors 33A and 33B are positioned at either of the two front and rear positions via the bracket 35, but, in either position, does not deviate from the range P.

The switch 32 is attached to the inside of a stay 6 (right side of the stay 6 in Fig. 5) at an upper end portion thereof that is attached on the rear frame 5, and a lever 31 of the switch 32 always urges the plate 34 inwards due to a force of a spring, not shown, as shown in Fig. 5.

According to the above construction, when the roll of paper S is not contained within the paper holder 10, the plate 34 is pressed by the lever 31 to be rotated inwards so that the detectors 33A and 33B protrude into the paper holder 10, respectively. Then, when the roll of paper S is contained within the paper holder 10, one of the detector 33A and 33B is pushed by one of the end faces of the roll of paper S, so that the plate 34 is rotated outwards, and the detectors 33A and 33B are retreated outwards out of the paper holder 10. At this time, the lever 31 is inclined outwards by the plate 34, so that the switch 32 is turned off. And the roll of paper S is reduced in diameter along with the consumption. When both of the

detectors 33A and 33B get disengaged with the end face of the roll of paper S, the plate 34 is pressed by the lever 31, and the detectors 33A and 33B protrude into the paper holder 10 again, respectively. At this time, the switch 32 is turned on. An on/off signal of the switch 32 is processed by a control section provided in the printer main body 21, and at the on time, an indicator such as an LED is lighted (control section and display section, not shown) to warn that the amount of remaining paper is small.

The operation of the printer 1 will be set forth in each installation state of the horizontal placement and vertical placement.

(1) Horizontal placement

In the horizontal placement, the printer is placed with the bottom plate 13 being on the underside, as shown in Figs. 1 to 3. The roll of paper S is positioned by the guide groove 15A due to its own weight, and as the roll of paper S is consumed, it is reduced in diameter along the locus A. On this course, the detector 33B is disengaged from the end face of the roll of paper S. However, since the detector 33A is contact with the end face of the roll of paper S, the plate 34 is still rotated outwards, namely, the switch 32 is in the off state. When the roll of paper S is further reduced in diameter, the detector 33A is finally disengaged from the end face of the roll of paper S. Then, the plate 34 is pressed against the lever 31, so that

the detectors 33A and 33B protrude into the paper holder 10, respectively, and the switch 32 is turned on. Thereby, a predetermined indicator is lighted, warning that the paper S is shortly exhausted.

A method for adjusting the amount of remaining paper when the warning is issued will be set forth below.

When the bracket 35 is moved backwards to locate the detector 33A away from the guide groove 15A, the diameter to be detected is larger, whereby the amount of remaining paper is larger. Conversely, when the bracket 35 is moved forwards to bring the detector 33A closer to the guide groove 15A, the diameter to be detected is smaller.

## (2) Vertical placement

In the vertical placement, the printer 1 is placed with the back plate 14 being on the underside, and the print head 20 being on the upside. The roll of paper is positioned by the guide groove 15B due to its own weight, and as the roll of paper S is consumed, it is reduced in diameter along the locus B. When the roll of paper S is further reduced in diameter, the detector 33B is disengaged from the end face of the roll of paper S. Then, the detector 33A and 33B protrude into the paper holder 10, respectively, and the switch 32 is turned on. Thereby, it is warned that paper is shortly exhausted in the same way as above. In this state, the paper drawn out of the roll of paper S is conveyed through the gap 34a provided between

the two detectors 33A and 33B.

Adjusting the amount of remaining paper is enabled in the reverse way as in the horizontal placement. That is, when the bracket 35 is moved forwards to locate the detector 33B away from the guide groove 15B, making the diameter to be detected larger. Conversely, when the bracket 35 is moved backwards to bring the detector 33B closer to the guide groove 15B, the diameter to be detected is smaller.

In the printer 1 as described above, the detectors operate in accordance with the installation state, whether in the horizontal placement or vertical placement (i.e., detector for horizontal placement 33A in the horizontal placement or detector for vertical placement 33B in the vertical placement), whereby the paper near end can be correctly detected. Accordingly, when the installation state is changed, there is no need of moving the paper near end detecting means 30, whereby the user is released from the trouble.

Also, since two detectors 33A and 33B that are integrated as a piece via the plate 34 are disposed within the range P, and a single switch (switch 32) detects the operation of the plate 34, there is no need of providing a combination of the switches for the detectors 33A and 33B. Namely, it is possible to operate two detectors 33A and 33B with one switch. Therefore, the paper near end detecting means 30 can be made compact, and the smaller number of parts and the simpler constitution can

be accomplished.

Also, the diameter of the roll of paper S for detecting the paper near end can be changed at two stages by moving the detectors 33A and 33B together with the bracket 35. Such a function can be applied in the cases where the diameter of the roll of paper for detection is desired to be constant with a core of different size or with paper of different thickness.

Moreover, in the installation state of vertical placement, paper drawn from the roll passes through the gap 34a provided between the detectors 33A and 33B after the detector 33B gets disengaged with the roll of paper S. Therefore, the paper can be smoothly conveyed without interference with the detectors 33A and 33B, and there is no malfunction in the detectors 33A and 33B due to the contact with the paper, whereby the paper near end can be detected stably. In this embodiment, the gap 34a is provided to allow paper to be passed between the two detectors 33A and 33B, but the same effect can be achieved by forming a gap in a single detector.

As was described above, according to the invention, the detectors as the paper near end detecting means are disposed at appropriate positions in accordance with the installation state, whereby there is no need of moving the detecting means in any of the installation states. It lightens the burden on the user, and brings the effect that the paper near end can be correctly detected in accordance with the installation state.